A NOTE ON THE *PHYLLOXERA VASTATRIX* AT THE CAPE

L. Peringuey, F.E.S.; F.Z.S., Assistant Curator South-African Museum.

August, 1887.

On the 6th January, 1886, it was officially ascertained that the dreaded *Phylloxera Vastatrix* was at work in some vineyards in the neighbourhood of Cape Town, and a few days later a largely infected centre was found also at Moddergat, in the district of Stellenbosch. The contaminated area was covering some 50 hectares = 125 acres.

A special Commission, consisting of Messrs. R. Trimen, F.R.S., Curator of the South African Museum, Professor MacOwan, F.L.S., Director of the Botanic Gardens, and myself, was appointed by the Government of the Colony in order to ascertain by personal inspection of the vineyards the extent and importance of the phylloxerised centres, and to advise the Government on the measures to be taken against any further spreading of the insect-pest.

Having been since appointed Inspector of Vineyards, I have been able to carry a series of technical observations, which I embody here, having culled them from the official reports made to the Government. The result of these observations, differing in many points from those made in Europe, may be found to be useful later on if the insects were spreading.

THE DEVELOPMENT OF THE PHYLLOXERA AT THE CAPE.—SUBTERRANEAN FORM.

The necessity of ascertaining the time at which the exodus of the female insect takes place, and also if there was or was not a season of hibernation, was very great, since on those observations depended the greater or lesser efficacy of the measures taken against the spread of phylloxera.

For that purpose several vines were planted in large boxes, fixed so as to allow of ready access to the roots, and capped with large glass cases. I operated mainly on 9 vines:—

1 to 6—6 Cape varieties of "*Vitis vinifera.*"
7 to 8—2 American vines, "*Vitis æstivalis.*"
9—1 wild vine, "*Cissus capensis.*"

The object in view was to ascertain:—Firstly, whether the multiplication or evolution of the insect was checked either by cold or extreme heat; and secondly at what time of the year the winged female came out of the ground.

Dr. Cornu has established with certainty that in France a temperature of about 10° C. (or 49° Fahr.) causes the phylloxera to hibernate, that is to say, under that climatic influence the gravid female dies, and the young—the insect before it has shed its first skin—becomes motionless, shrivels up, and may be said to be dormant. No harm is done to the vine at that period, middle of October to middle of November; as soon, however, as the temperature rises above 49° Fahr. a general awakening takes place, and the insect begins its course of destruction. This period of renewal of activity may be said to begin in May in the south of France, and towards the end of it in

the western parts. In a letter which I had the honour to receive from him, Mons. Cornu mentions having also noticed a similar result produced by an excessive drought and heat; his observations have been ulteriorly confirmed by those of Balbiani.

It might have been hoped that the extreme heat and dryness of the climate from November to April would have here acted as the low temperature (10° C.) does in France.

Unfortunately there is no ground for such a hope. The phylloxera does not ætivate, and remains extremely active from September to the middle of April, as shown by the observations—up to date—made not only in my conservatory, where, in spite of all precautions the heat is naturally greater—varying from 66° to 106° Fahr.,—but also in the fields.

In extremely compact argillaceous soil, the surface of which is baked, I have sometimes met with insects, somewhat sluggish in comparison to those at a greater depth, but that was immediately under the surface only, and they were *not* dormant.(1)

I had occasion to examine the roots of one of the vines in the conservatory with a heat of 87° Fahr., and the insects, both near the surface and also at a depth of 24 inches, were equally active; they were, however, more numerous at that depth, and had sought evidently a damper surrounding.

The effect of the rainy season (winter?) has been, however, very peculiar, and produced a result nearly akin to that of the hibernation in France.

After the cold and rainy weather experienced in May last year, I was greatly surprised to find the insect in a semi-comatose state; the body of the gravid female no longer so spheric or pyriform as usual, was not distended with eggs in the majority of cases; the young were not active, and the insect in its different stages had assumed a leaden hue, was motionless, *but not dead.*

When exposed to a little warmth, both female and young revived rapidly; a few hours exposure to artificial heat was sufficient, and a female even gave me three eggs the following day. Towards the end of August the phylloxerae in the conservatory had awakened from their stupor, and on the 10th of September the roots of the vines were teeming with phylloxera-life.

The field observations were made at Mowbray, the only place where I could at that time observe the insect *in situ.*

From statistics kindly supplied to me by the Meteorological Commission the mean temperature recorded at the Observatory has been in May, 63·1; June, 56·9; July, 53·8; August, 55·6; and September, 58·5; the lowest minimum being in May, 47·8; June, 49; July, 44·4; August, 47·8; and September, 49·9. Thus the mean temperature of 49°, which, according to Cornu, causes the phylloxera to hibernate, has not been reached at Mowbray, and the semi-hibernation of the insect observed by myself at the end of May points to a *racial predisposition* in the insect, which leads to the supposition that it has been in the Colony for a short time, and has not been sufficiently acclimatised as yet to be insensible to a period of cold superior to that causing a complete hibernation in Europe. As for the greater period of heat,

(1) These conclusions have since been strengthened by my observations during the winter, for the vines in my conservatory.

I have conclusively shown that it has here no checking influence on the insect. That does not invalidate the theory of recent introduction because it is well known that insects are not so affected by heat as they are by cold.

If we take into consideration the small duration of cold weather experienced on the coast districts, we may conclude that this short period of rest is nothing when compared with the immense advantage the insect derives from the favourable circumstance of a hot and dry climate. Every observer in France had to arrive at a similar conclusion.

Dr. Cornu found that with the temperature varying between 86° and 95° Fahr. (30° to 35° C.) the young hibernant had laid its first egg in twelve days. This gives three days for each shedding of skin. This result corroborates the observation of the late Mons. Lichtenstein. This observer found that a constant temperature of about 76° Fahr. (25° C.) would allow the development of the winged form in eighty to ninety days.

I have been able to obtain the same result here, as will be seen hereafter.

From the foregoing remarks it will be seen that the danger of dissemination of the insect from May to September, while I was unable to do anything against it for want of a disinfecting agent, has been greatly lessened, and also that the application of Bisulphide of Carbon should be made early in September.

AERIAL FORM.

The spreading of the phylloxera takes place mostly in the ground. It has also been found walking on the soil, but the contamination at great distances is due mainly to the winged form.

For a long time the winged form was considered as very rare. But the observations of Dr. Cornu have shown that it was purely due to the fact that it was looked for where it does not easily develope, and that the *nymphs*, which ultimately become winged females, are not to be found generally on the roots, but on the swellings of the rootlets.

These rootlets being of course more numerous on healthy vines, it follows that in a contaminated vineyard the winged female will be produced in large numbers during the first year of infection.

But the rootlets wither generally towards the end of summer, and the nymph, owing to the difficulty of getting more nodosities (as when attacked the rootlet soon rots, and the death is accelerated by the number of phylloxera which derive their sustenance from it) gets probably at that time near the surface of the soil, and there, after a last shedding of skin, emerges as a winged form.

On the ground of these observations, the Commission was led to expect to get the winged form late in the year, although numerous nymphs had been met with everywhere.

Two vines, six months old, well stocked with insects, were deposited in the laboratory. They came from Mr. Kotze's vineyard at Mowbray, and were planted in the original compact argillaceous soil.

On the 23rd of April only I obtained the first winged insect; the exodus continued until the 5th of May, and then ceased; a copious watering of the plants after the first exodus having seemingly increased it. The exodus coincided with the appearance in the open air of numerous other winged forms of *Aphidæ*.

I should here state that the insects flying against the panes of glass which cover the boxes, and on which the vapour from the ground condenses, are glued against them and easily detected.

At the time I placed those two vines in the conservatory [February] there were several nymphs on the rootlets. Supposing that those nymphs became the winged females, which I had collected later on, they have required 56 days to assume the winged form.(2)

On the 6th of December of the same year I brought from Modder-gat a large quantity of insects, with which I stocked three Cape vines, 1 wild vine, 2 American *Vitis Aestivalis*, and placed also a small amount of them, among which I could see no nymph, at the foot of the very vine from which the exodus had taken place six months previously. On the 10th of January I got the first winged form from that same vine, which up to date has given me twenty-four; vine No. 2, stocked in December, has given me eight. Two young vines planted this year have given me nothing as yet; neither have the two American vines, nor has the insect taken to the wild species, *Cissus capensis*.

I do not believe that this is the final exodus, which I expect in May or June, when the rainy season sets in. No other *Aphidæ* have yet appeared abroad.

The result of those observations are thus somewhat different from those observed in France. The young vine No. 1(3), which has given me last year fourteen winged females only, has given me twenty-four this year, and it is in the last stage of decay. The two young vines 3 and 4 (which do not thrive very well) have as yet given me none. It might be deduced from this that here the winged form is not produced in greater number during the first year of infection.

Vine No. 2, stocked with insects from Moddergat, has, however, yielded eight winged female from the 13th of January, *i.e.*, thirty-five days after it had been stocked; and I conclude that the measures taken to destroy the centres from which those insects came have been instrumental in checking the first exodus, and in preserving the adjacent vineyards from contamination at any distance.

The life history of the phylloxera presents, however, some difficulties which are not easily accounted for, and the theories of the late Mons. Lichtenstein, which went far towards their solution, have not been accepted by every entomologist. It is therefore with great satisfaction that I record here a similar result to that obtained by that distinguished aphidographist, viz., the development of the winged form in about ninety days, with a nearly constant temperature of 72° Fahr.

I hasten, however, to explain that the observations I have been able to make have been too few to decide decisively the points still obscure which I have been treating of. They must be repeated again and again, under different climatal circumstances. They have only been made in one locality, and atmospheric influence is well known to act in many different ways on *Aphidæ*.

---

(2) It is very probable that a previous exodus had taken place from that same vine before I placed it in the conservatory.

(3) Vine No. 2 being nearly dead was removed from the box in September, three months after the exodus.

Incomplete as they are, they unfortunately lead to a most calamitous conclusion, viz., that the spread of the phylloxera at the Cape, if left unchecked, is more rapid than in any other country where the insect has established its footing.

MEASURES TAKEN FOR THE DESTRUCTION OF THE INSECT.

The Commission could not hesitate with regard to the destructive agents to be employed. Following the recommendation of the *Commission Supérieure du Phylloxera*, and a *destructive*, not a *curative* agent being required, they decided on using Bisulphide of Carbon (C.S.^{2}) The quantity of water available for the use of Sulfo Carbonates being here either insufficient or not easily attainable.

I applied at first 300 grammes of Bisulphide per square metre, in three treatments of 100 grammes each, and with nine holes of injection, but further experiments have shown that 200 grammes per square metre were quite sufficient.

The submersion system has been also resorted to. It being found that a part of Mr. S. Kotze's vineyard could be submerged from the water of the Liesbeek River, the Government authorised the throwing of a dam to put to the test the submersion system, and a surface of some nine acres, divided in two dams, was kept under water for a period of sixty days; the ground which was thrown up for embankments had previously been treated with Bisulphide.

That period of sixty days was not decided upon at random. Owing to the numerous fatty tubercles which cover its body, the phylloxera is not easily wetted; it can be immersed in a liquid without being in direct contact with it, being enveloped in air. Dr. Maxime Cornu has also shown that the new layer which separates the old bark from the new (the very dry exterior part of the new *suber*) is damped with very great difficulty only; and a long period of submersion is therefore required to change the conditions in which this suberose layer remains dry, and meanwhile affords means of subsistence to the insect.

Professor Balbiani has shown also in his admirable researches on the structure and vitality of the egg of the phylloxera, that when immersed in water, at the time the embryo had only begun to appear, or was but little developed, they accomplished their evolution until they were hatched, and that if the embryo was already well developed, the young often died in the egg, but only after a long stay under water.

A submersion of forty days has been found sufficient in Europe, but it has to be repeated every two years, and Balbiani ascribes that necessity to the escape of a few eggs.

The endeavour of the Phylloxera Commission has been to leave as little as possible to chance, and after a submersion of sixty days from the 1st of September—that is to say at about the time of renewal of activity in the part of the insect—I have vainly sought for a phylloxera on the roots of the few vines which have survived that long stay under water.

The importance of this experiment at the Cape is very great. Many farmers would be able, were the contagion to spread, to submerge parts of their vineyards at a comparatively small expense now that a trial has been made which, up to date, has given satisfactory results.

No new centre of infection has been discovered up to the present time, and this year a large area of vines surrounding the original phylloxerised centres has received treatments of cultivation varying from 24 to 60 grammes of Bisulphide per square metre.

These treatments have been given a little late in the year, in order to allow the development of the *winter-egg*—which I have not met with here, but before the exodus of the winged form has begun.(4)

ON THE ORIGIN OF THE DIAMOND-MINES OF SOUTH-AFRICA.—By R. Marloth, Ph.D.

[Read 1886, March 31.]

More than fifteen years have elapsed since digging for diamonds was started on the places still bearing the name of Diamond Fields, although they are surrounded now by well populated cities. This corner of Griqualand West has become of the highest importance for the whole of South Africa, but the more scientific question about the origin of these wealth-producing mines has not been sufficiently answered as yet. I do not pretend to give a new theory which disposes of all the difficulties and all the doubts respecting the formation of the mines, but I hope that the following remarks may contribute a little towards the solution of this problem, so that future geologists, aided by a larger amount of observation, may succeed, where we with our fragmentary knowledge thereof still fail.

All those who take some interest in the question know that the diamondiferous mineral, the blue ground of the digger, is found only in funnel-shaped holes, the bottom of which has not been reached yet. There are four such holes principally worked at present, but as Kimberley Mine, where sinkings have been made down for a depth of 600 feet, is the best explored of all, I restrict myself to this mine.

The general opinion as to its formation is, that the orifice has been formed by volcanic forces, and that the blue has been upheaved from a greater depth, transporting thus the diamonds to their present place. However, this orifice is not the crater of a volcano, as has been stated in various publications, for instance by Mr. Chaper in his book "Note sur la région diamantifère de l'Afrique australe." It is only the pipe which connected the crater with the interior of the globe, and the crater, if there was any at all, has been washed away during the long denudation which altered entirely the surface of South Africa.

So far the question is pretty clear; but a more serious divergence of opinions exists on the state in which the diamondiferous mineral came to its present place. Some geologists, as for instance Mr. Dunn, who is now in Australia, and Professor Cohen from Strassburg, declare it to be an igneous product, a kind of lava, which filled out this volcanic orifice and hardened there. They mention in favour of their theory especially the nature of the mineral, which they class near to the serpentine. But how, I must ask at once, is it then to be explained, that not a single bit of the numerous fragments of the various rocks and shales, embedded in the blue, exhibits a sign of fusion or alteration by heat? This ought to be certainly the case, if the blue stuff,

(4) The exodus of winged females began on the 13th of January, 1887, and this year on the 1st of the same month.